

# Asymptomatic Cardiovascular Changes and Complications in Type 2 Diabetes Mellitus

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## ABSTRACT

### BACKGROUND

Diabetes mellitus is a metabolic disorder distinguished by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. Sustained hyperglycaemia is associated with complications in the macro vasculature, microvasculature, and nerves, causing prolonged morbidity and premature mortality. We wanted to study the asymptomatic cardiovascular changes and complications in T2DM.

### METHODS

This is a cross-sectional study done at Katuri Medical College, Guntur among 60 type 2 DM patients who attended OPD and IPD between November 2018 and September 2019.

### RESULTS

Majority of the patients in our study (40, 66.67 %) belonged to 5<sup>th</sup> decade. 50 % patients in this study (30 out of 60) had diabetes of less than 5 years duration. 20 patients (33.33 %) had diabetes of 5- to 10-years duration and 10 patients (16.67 %) had diabetes for more than 10 years. Among these 11 patients (18.33 %) showed inducible ischemia in exercise test; 8 patients (72.73 %) were above 50 years of age; remaining 3 (27.27 %) were below 50 years of age which tells us that ischemia develops as age advances even without prominent symptoms. All these 11 patients who had inducible ischemia in exercise test showed ST depression of more than 1 mm without angina.

### CONCLUSIONS

Even though males were more, not much sex difference was detected in the incidence of type 2 diabetes mellitus. Most of the patients were in 5<sup>th</sup> decade of life; commonest lipid abnormality seen in our patients is hypertriglyceridemia; none of our patients had resting ECG changes or 2D Echo cardiac abnormalities. 18.33 % (11 out of 60) of asymptomatic diabetics presented with inducible ischemia on TMT without symptoms of angina or chest pain. We had low incidence of family history of diabetes (4 %). All patients who had family history showed inducible ischemia in our study. Truncal obesity which is measured by waist / hip ratio is best indicator of silent ischemia in diabetes than BMI. Autonomic neuropathy was noticed in 4 out of 11 asymptomatic diabetics who presented with inducible ischemia on TMT.

### KEYWORDS

Diabetes Mellitus, Silent Myocardial Infarction, Lipid Abnormalities, Body Mass Index, Acute Coronary Syndromes

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**BACKGROUND**

Diabetes mellitus is a metabolic disorder distinguished by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. Sustained hyperglycaemia is associated with complications in the macro vasculature, Microvasculature, and nerves, causing prolonged morbidity and premature mortality. CAD, Stroke, and peripheral vascular disease are the major macrovascular complications with a 2- to 4-fold rise in incidence compared to the general population. Microvascular complications such as retinopathy and nephropathy and peripheral and autonomic neuropathy are also known.<sup>1</sup> Two main categories of diabetes are distinguished. Namely,

**Type 1.**

Formerly known as insulin-dependent diabetes mellitus (IDDM) or juvenile-onset Diabetes – usually manifests before adulthood and accounts for about 5% of all cases. Type I Diabetes rises mainly through autoimmune destruction of pancreatic β- cells, which leaves the patients in severe Insulinopenia and extreme hyperglycaemia. If untreated, insulin deficiency culminates in fatal ketoacidotic coma.<sup>2</sup>

**Type 2.**

Diabetes - Formerly known as non-insulin dependent diabetes mellitus (NIDDM) or maturity - onset diabetes manifesting in later adult life and accounting for about 95 % of all cases. This type of diabetes develops mostly through a mixture of insulin resistance and defective B - Cell function. Type 2 diabetes causes less severe hyperglycaemia that is not usually life-threatening. However, chronic complications of type 2 diabetes cause severe clinical burden, eroding the quality of life and reducing the life expectancy. The progressive and heterogeneous nature of type 2 diabetes adds to the intricacy of treatment, which usually requires one or more oral antidiabetic agents and may also necessitate the use of insulin.

It is well established that Coronary artery disease is a important complication of diabetes. Mellitus representing the ultimate cause of death in more than half of all patients with this disease.<sup>3</sup> Myocardial infarction in diabetic patients is more affluent when compared to non - diabetic patients, and the long-term Survival rates for diabetic patients is lower than that of non - diabetic patients.

Chest pain is undoubtedly the main symptom of ischemic heart disease and the one most commonly used to establish the type and efficacy of the treatment. However, several studies propose that many individuals with numerous studies have demonstrated that the presence of silent ischemia during exercise testing or AECG monitoring. It is well recognized that patients with diabetes mellitus have higher morbidity and mortality from cardiovascular disease than nondiabetic patients.<sup>4</sup>

**Objectives**

1. To know the cardiac changes existing in patients of type 2 diabetes who do not have any symptoms relating to the cardiovascular system by Resting ECG & Treadmill test and 2D Echocardiogram.
2. To demonstrate the increased incidence of silent myocardial ischemia in asymptomatic Patients of Type 2 diabetes mellitus

**METHODS**

This cross-sectional study was done at Katuri Medical College, Guntur among 60 patients who attended OPD and IPD between November 2018 and September 2019. The initial evaluation included a medical history taking, physical and systemic examinations. After the above procedures, routine and specific investigations were done. The patients with type 2 diabetes mellitus for more than one year, who do not have any complaints relating to the cardiovascular system, were included. Investigations done included urine examination, fasting and post prandial blood sugar, serum total cholesterol, serum HDL cholesterol, serum triglycerides, serum creatinine, fundus examination, ECG, echo cardiogram and treadmill stress test

**Inclusion Criteria**

1. Type 2 DM of > 1 yr. who do not have any complaints relating to the Cardiovascular System.
2. Age 30-75 years.

**Exclusion Criteria**

1. NIDDM <1 Yr.
2. History of MI, Angina, Heart failure, Arrhythmias, LBBB.
3. Uncontrolled BP.
4. Significant Aortic Stenosis.
5. Cardiomyopathy.
6. Previous coronary artery bypass surgery.
7. Treatment with Digoxin.
8. Severe Chronic disease.
9. Insulin treated then duration from diagnosis to insulin therapy <2 Yrs.
10. CVA with Neurological deficit.

**RESULTS**

Sex	No	%
Male	32	53.33
Female	28	46.67
<b>Total</b>	<b>60</b>	

*Table 1. Distribution According to Sex of the Study Group*

Sex	Mean Age	S.D.
Male	48.84	9.88
Female	54.33	7.36

*Table 1.1. Significance of Sex Distribution and Standard Deviation*

Duration in Years	No	%
<5 years	30	50
5 - 10 years	20	33.33
11 - 15 years	6	10
>15 years	4	6.67
<b>Total</b>	<b>60</b>	

**Table 2. Age Distribution of Study Group in the Present Study**

FBS in Mg %	No	%
≤130	6	10
131 - 150	15	25
151 - 170	10	16.67
171 - 190	9	15
>191	20	33.33
<b>Total</b>	<b>60</b>	

**Table 3. Distribution of FBS in the Study Group**

## DISCUSSION

This study of asymptomatic cardiac changes in Type 2 Diabetic Mellitus was undertaken at Katuri Medical College, Guntur, among patients who attended OPD and IPD between November 2018 and September 2019. This study included 60 NIDDM patients. The initial evaluation included a medical history taking, physical and systemic examinations. Even though Males were more, not much sex difference observed in the incidence of type 2 diabetes in this study (32 Males and 28 Females). This coincides with Majority of studies<sup>2,5</sup> done outside which points out that there is no sex difference in the incidence of Diabetes.

Majority of the patients in our study, 40 patients (66.67 %) belong to 5th decade. 50 % patients In this study (30 out of 60) had diabetes less than 5 years. 20 patients (33.33 %) had diabetes of 5-10-year duration and 10 patients (16.67 %) had diabetes more than 10 years.

Lipid abnormalities are associated with higher incidence of ischemic heart problem more so in diabetes. The most obvious lipid abnormalities noted in our study was hypertriglyceridemia and Low HDL levels. 31 patients (51.66 %) showed high triglycerides and 29 out of 60 (48.33%) showed low HDL. only 12 (20%) showed high total cholesterol and 9 patients (15%) showed high LDL above 130 mg%.

None of our patients showed any cardiac abnormality at rest. (in Resting ECG and 2D ECHO) Treadmill test was undertaken in all the 60 patients out of whom 11 patients showed inducible ischemia changes without angina. This study coincides with majority of studies done previously. This study coincides with the study done by Pasupathy S. et al.,<sup>7</sup> who in their study demonstrated inducible ischemia in 17% of cases (11 out of 63 cases) by TMT,<sup>4,6</sup>

Among these 11 patients in our study (18.33%) those showed inducible ischemia in Exercise test, 8 patients (72.73%) were above 50 years of age and remaining 3 (27.27%) were below 50 years of age which tells us that ischemia develops as age advances even without prominent symptoms. All these 11 patients who had inducible ischemia in exercise test showed ST depression of more

than 1 mm without angina which happen in another study.<sup>7</sup>

In our study, autonomic neuropathy was detected in 4 out of 11 asymptomatic diabetics those presented as inducible ischemia on TMT. In diabetic patients, autonomic neuropathy was held responsible for absent anginal pain during ischemic episodes. In a recent study to correlate the incidence of autonomic neuropathy and silent myocardial ischemia in type 2 diabetic patients by Chico A. et al., silent myocardial ischemia was detected in 13 (26.6%) diabetic patients in general. 9 (66.7%) of them had autonomic neuropathy.<sup>8,9</sup> It tells us the need of screening of diabetic patients with autonomic neuropathy which is also evident in our study.

Paradoxically only 4% of our patients showed family H/O of diabetes. All the patients who had family H/o of diabetes (2 patients) also showed silent myocardial ischemia. Thus, the status of family H/O in asymptomatic diabetics cannot be ruled out.

Our study shows BMI (body mass index) of less than 25 in 28 patients (46.67%) and more than 25 in 32 patients (53.33%). Thus, our study coincides with majority of studies which say higher incidence of weight in diabetics<sup>10,11</sup>

In our study waist / hip ratio is more than normal levels [ $>0.95$  (M) and  $>0.90$  (F)] in 51 patients (85%) out of 60 patients. In 11 patients who had inducible ischemia, 9 (81.82%) had W/H ratio above normal levels. So, W/H ratio in above normal levels is an important marker for cardiac risk. This finding coincides with majority of the studies world-wide.

## Summary

Present study was undertaken at Katuri Medical College to know the cardiac changes present in patients of type-2 diabetics who do not have any symptoms relating to cardiovascular system and to demonstrate increase presence of silent myocardial ischemia in asymptomatic patients of type-2 diabetes mellitus.

60 type 2 diabetic patients of more than one-year duration were included in this study. All were assessed with detailed history, clinical examination & relevant investigations (FBS, ECG, 2D ECHO, Treadmill test) and the results were tabulated.

In this study group of 60 patients, 32 patients were Males and 28 patients were Females. The mean age of Males being 48.84 yrs.  $\pm$  9.88 and mean age of Females being 54.33  $\pm$  7.36. Most of patients in our study were in the age group of 40 - 50 yrs. at the onset of diabetes. Only 8 patients (13.33 %) were above 50 years of age at the onset of diabetes. Maximum patients in our study group (30 patients) i.e. 50 % had diabetes of less than 5 yrs. and 20 patients (33.33 %) in our study had poor glycaemic control.

Although high total cholesterol was noted in only 12 patients (20 %) in our study group, hypertriglyceridemia was present in 31 patients (51.66 %) in

study group. Since patients of uncontrolled blood pressure was omitted from our study group, 5 patients (8.33 %) in our study group had systolic blood pressure of more than 160 mm Hg.

All the patients in our study group showed normal ECG and 2D ECHO, 11 patients in our study (18.33 %) showed inducible ischemia in exercise test. Mean age of the patient those presented silent myocardial ischemia was  $55.63 \pm 10.99$ . Out of 11 patients those showed myocardial ischemia in exercise testing, 8 patients (72.73 %) were above 50 years. The mean age of this age group was  $60.625 \pm 7.836$ . Poor glycaemic control and hypertriglyceridemia was prominent in these 11 patients those showed myocardial ischemia in exercise test.

Total mean duration in stress test positive patients was 6.78 yrs.  $\pm$  5.49 yrs. and maximum patients (5 patients) had diabetes of less than 5-year duration. In this study group of 60 patients, 32 patients showed body mass index of  $> 25$ . Mean age being  $27.375 \pm 1.18$  yrs. In the stress test positive Patients if 11, 7 patients showed BMI of  $> 25$  (63.64 %)

51 Patients (85 %) in our study group showed high waist hip ratio ( $>0.95$  in Males and  $> 90$  in Females) and mean W/H ratio being  $95 \pm .035$  in the

Thus, the present study shows patients with type 2 diabetes of longer duration particularly after 4th and 5th decade should undergo evaluation for inducible ischemia even though they are asymptomatic group of stress test positive patients, 9 patients (81.82%) presented with high waist hip ratio mean being  $964 \pm .035$ .

This study shows that early detection and control of diabetes is essential. Apart from diabetes and triglyceridaemia, obesity especially truncal obesity is a chief risk factor of coronary] artery disease, even though patients do not have any symptoms linking to cardiovascular system, all patients of type-2 diabetes should undergo evaluation for silent myocardial ischemia.

## CONCLUSIONS

Even though males were more, not much sex difference was detected in the incidence of type 2 diabetes mellitus. Most of the patients were in 5<sup>th</sup> decade of life. Commonest lipid abnormality seen in our patients is hypertriglyceridaemia. None of our patients had resting ECG changes or 2D echocardiography abnormalities. 18.33% (11 out of 60) of asymptomatic diabetics presented with inducible ischemia on TMT without symptoms of angina or chest pain. We had low incidence of family history of diabetes (4 %). All patients who had family history showed inducible ischemia in our

study. Truncal obesity which is measured by waist / hip ratio is the best indicator of silent ischemia in diabetes. Autonomic neuropathy was noticed in 4 out of 11 asymptomatic diabetics who presented with inducible ischemia on TMT.

Thus, the present study shows that patients with type 2 diabetes of longer duration, particularly after 4<sup>th</sup> decade should undergo evaluation for inducible ischemia even though they are asymptomatic.

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